Protein synthesis

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Nucleic acids and protein synthesis
Sub Topic	Protein synthesis
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : **66 minutes**

Score : **/ 55**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a** **D** – <u>uracil</u> **;**
E – <u>adenine</u> **;**
F – <u>ribose</u> **;** **I** pentose / sugar
G – <u>phosphate</u> **;** **A** phosphate

(b) *answers must be in pairs*

mRNA	DNA
ribose	deoxyribose **;**
differences between pentoses / sugar may be described in terms of OH on C2	
uracil / no <u>thymine</u>	<u>thymine</u> / no uracil **;**
single, polynucleotide / strand / chain	two, polynucleotides / chains / strands **;** **A** double
no hydrogen bonds	hydrogen bonding **;**
not a helix / straight chain	(double) helix **;**
ratio of A+G to C+T varies / AW	ratio of A+G to C+T = 1 / AW ;
no base pairing (within molecule)	base pairing **;**
base pairing A-U with, tRNA / anticodon	base pairing is A-T
shorter	longer **;**
found in cytoplasm / leaves nucleus	found in nucleus **;**
attached to ribosome(s)	not attached to ribosome(s) **;**
short-lived	long-lived **;**
transfer of information (to ribosome)	information storage / AW **;**
codes for one polypeptide	codes for more than one polypeptide **;**
produced by transcription	produced by (semi-conservative) replication

[max 3]

(c) **1** translation **;** **R** *if transcription given as well, unless in correct context*
A use of, nucleotide / base, sequence, to make, amino acid chain / polypeptide / protein
I protein / polypeptide, synthesis
2 moves towards / combines with, ribosome **;**
3 ref to small and/or large sub-units **;** **I** small / large ribosome
4 <u>codon</u>(s) **;** *only accept in correct context*
5 transfer / t, RNA, bringing, amino acid(s), to mRNA / ribosome **;**
6 <u>anticodon</u>(s) **;** *only accept in correct context*
7 (complementary) base pairing **;**
8 any e.g. of codon:anticodon base pairing **;** *need six bases*
9 ref to polyribosome(s) / used by many ribosomes **;**
10 (mRNA short-lived) ref to production of protein for short period of time **;** [max 4]

[Total: 11]

2 **(a) (i)** **A** transcription ;
B tRNA / transfer RNA ;
C ribosome ; **A** subunit of ribosome / ribosomal subunit
treat 70S / 80S or small / large as neutral
D anticodon ; [4]

(ii) *similarities*

made of amino acids / amino acid monomers / polymer of amino acids **A** protein / polypeptides
have quaternary structure / have more than one polypeptide chain ;
four, sub-units / polypeptides ;
haem / porphyrin / prosthetic group(s) ; [2 max]

difference

(four) sub-units / polypeptides, are identical ;
or
haemoglobin has, two different, sub-units / polypeptides ;
or
haemoglobin has alpha and beta polypeptides ;

(catalase) has active site(s) ; **A** Hb has (oxygen) binding site [1 max]

(iii) each, sub-unit / polypeptide, has an active site ;
catalase has four, active sites / haem groups ; [1 max]

(b) iodine in potassium iodide solution / iodine in KI solution / I in KI solution ; **A** iodine solution **R** iodine

Benedict's, solution / reagent ; **A** Benedict's
A Fehling's solution / NaOH and $CuSO_4$ [2]

treat refs to colour changes as neutral

[Total: 10]

Question			Expected Answers	Marks
3	**(a)**	**(i)**	**A** transcription; (ignore mRNA synthesis)	
			B translation;	
			C exocytosis; **R** secretion	**[max 3]**
		(ii)	**D** (sub unit of) ribosome	
			E Golgi apparatus/body;	**[2]**
		(iii)	**F** mRNA;	**[1]**
	(b)		active site;	
			(is) specific shape; **A** complementary/other amino acids are the wrong shape to fit, **R** same shape	
			only accepts R groups of these two amino acids; **R** accepts peptide bond	**[2]**
	(c)		correct bond broken (between C-N);	
			involvement of water molecule in breaking the peptide bond shown clearly;	
			<u>two amino acids with free groups as follows</u>	
			-COOH/-COO^- <u>and</u> -NH_2/-NH_3^+;	
			A from diagram(s).	**[3]**
				[Total: 11]

4 **(a** condensation **; A** dehydration [1]

(b) accept glycine-valine or valine-glycine

peptide bond drawn correctly ;
amino and carboxylic acid ends shown ;
correct R-groups ;
water eliminated ; [4]

(c) (i) GAU GUU AAG ; [1]

(ii) messenger ; [1]

(d) during systole semi-lunar valve is open ;
during diastole semi-lunar valve is closed ;
proximity/AW pulmonary artery to (right) ventricle (so no pressure lost) ;
elastic recoil of pulmonary artery maintains blood pressure/AW ;
no/little blood in (right) ventricle, after contraction/during diastole ;
fills with blood at low pressure ; [max 3]

(e) increase in power of contraction ; AW
increase in (systolic) blood pressure ;
strain on right ventricle/right ventricle does not function efficiently ;
growth of muscle in/right ventricle increases in thickness ;
insufficient oxygen to, heart/cardiac, muscle ;
heart failure/heart attack ; [max 2]

(f) persistent/AW, cough ;
cough produces much mucus ;
wheezing ;
rapid breathing/difficulty breathing/breathlessness ;
bluish colour to the skin ;
recurrent chest infections/frequent colds *or* 'flu/AW ;
barrel-shaped chest ;
chest pains ; **R** heart pains
fatigue/weakness, (with exercise) ; [max 2]

[Total: 14]

5 (a (i) GTG **;**

ACU **;**

leu **;** [3]

(ii) primary structure **;** [1]

(b) 1 mutation **;**
2 base substitution / T→ A in template strand of DNA / AW **;**

transcription
3 DNA has CAC as 6th triplet **;**
4 (so) mRNA has GUG as (6th) codon **;**
allow one mark for altered mRNA codon *if no marks gained for mps 3 and 4*

translation
5 different tRNA involved / tRNA specific to val and not glu **;**
6 anticodon on tRNA has CAC (with valine) **;**
7 tRNA brings, incorrect amino acid / val, to ribosome **;**
8 further detail **;** e.g. incorrect amino acid incorporated into growing polypeptide chain [max 5]

[Total: 9]